CLAIMS

What is claimed is:

1. Method of fabricating spring contact elements on a substrate, comprising:

applying at least one layer of masking material on a surface of a substrate and pattering the masking layer to have openings extending from areas on the substrate to positions which are above the surface of the substrate and which also are laterally and/or transversely offset from the areas;

depositing at least one layer of a conductive metallic material into the openings; and

removing the masking material so that the remaining conductive metallic material forms free-standing contact elements extending from the surface of the substrate, each contact element having a base end which is secured to a one of the areas of the substrate and having a free-standing tip end for making electrical connections.

2. Method, according to claim 1, further comprising:

prior to depositing the at least one layer of conductive metallic material, seeding the openings in the at least one layer of masking material.

3. Method, according to claim 1, wherein:

the substrate is an electronic component.

4. Method, according to claim 1, wherein:

the substrate is a semiconductor device.

5. Method, according to claim 1, wherein:

the substrate is a semiconductor wafer.

6. Method, according to claim 1, further comprising:

forming the openings in the at least one masking layer so that the base ends of the resulting spring contact elements have a larger cross-section than the tip ends of the resulting spring contact elements.

7. Method of making electrical connections between at least one first electronic component and a second electronic component, comprising:

fabricating spring contact elements directly upon at least one first electronic component, said spring contact elements each having a tip end which is spaced above a surface of the at least one first electronic component; and

bringing the at least one first electronic component together with a second electronic component so that the tip ends of the spring contact elements are in electrical contact with corresponding terminals on the second electronic component.

8. Method, according to claim 7, further comprising:

maintaining pressure between the at least one electronic component and the second electronic component.

9. Method, according to claim 7, wherein:

the at least one first electronic component is at least one active semiconductor device; and

the second electronic component is a test substrate;

further comprising:

powering up the active semiconductor device while maintaining the tip ends of the spring contacts in electrical contact with the terminals of the second electronic component.

10. Method, according to claim 9, wherein:

the at least one active semiconductor devices are resident on a semiconductor wafer.

11. Method, according to claim 7, wherein:

the at least one first electronic component is at least one memory chip.

12. Method, according to claim 7, further comprising:

joining the tip ends of the spring contact elements to the corresponding terminals of the second electronic component.

13. A microelectronic spring contact element, comprising:

an elongate member of length "**L**" having a base end portion, a contact end portion opposite the base end portion, and a central body portion contiguous with each of the base and contact end portions;

the contact end portion is offset in a first direction from the central portion by a distance "**d1**";

the base end portion is offset in a second direction opposite the first direction from the central portion by a distance "**d2**";

wherein:

the base end portion is secured fixed to an area of a first electronic component; and

the tip end portion is adapted in use to make a pressure connection with a second electronic component.

14. A microelectronic spring contact element, according to claim 13, wherein:

the spring contact element is thicker at the base end portion than at the contact end portion.

15. A microelectronic spring contact element, according to claim 13, wherein:

the spring contact element is wider at the base end portion than at the contact end portion.

16. A microelectronic spring contact element, according to claim 13, wherein:

the length "**L**" is in the range of 10-1000 mils.

17. A microelectronic spring contact element, according to claim 16, wherein:

the length "**L**" is in the range of 60-100 mils.

18. A microelectronic spring contact element, according to claim 13, wherein:

the elongate member has an overall height "**H**" which is the sum of "**d1**", "**d2**" and a thickness at the central body portion of the member; and

the overall height "**H**" is in the range of 4-40 mils.

19. A microelectronic spring contact element, according to claim 18, wherein:

the overall height "**H**" is in the range of 5-12 mils.

20. A microelectronic spring contact element, according to claim 13, wherein the spring contact element has one or more layers selected from the materials consisting of:

nickel, and its alloys;

copper, cobalt, iron, and their alloys;

gold (especially hard gold) and silver;

elements of the platinum group;

noble metals;

semi-noble metals and their alloys, particularly elements of the palladium group and their alloys;

tungsten, molybdenum and other refractory metals and their alloys; and

tin, lead, bismuth, indium and their alloys.

21. A semiconductor device having a plurality of terminals (bond pads) on a surface thereof, further comprising:

a plurality of spring contact elements fabricated directly upon the surface of the semiconductor device, each spring contact element having a base end at a corresponding one of the bond pads and a tip end disposed above the surface of the substrate and laterally and/or transversely offset from the base end.

22. A semiconductor device, according to claim 21, wherein:

each spring contact element has a tail portion contiguous with the base end; and

the tail portions of the spring contact elements effect routing.

23. A semiconductor device, according to claim 21, wherein the spring contact elements are made by:

applying at least one layer of masking material on the surface of the semiconductor device;

pattering the masking layer to have openings extending from bond pads on the semiconductor device to positions which are above the surface of the semiconductor device and which also are laterally and/or transversely offset from the bond pads;

depositing at least one layer of a conductive metallic material into the openings; and

removing the masking material so that the remaining conductive metallic material forms free-standing spring contact elements.

24. A semiconductor wafer, comprising:

a plurality of semiconductor devices resident thereon;

a plurality of spring contact elements fabricated directly on the semiconductor devices resident on the semiconductor wafer;

wherein the semiconductor devices resident on the semiconductor wafer are ready for burn-in and testing prior to being singulated from the semiconductor wafer.

25. A semiconductor wafer, according to claim 24, wherein the spring contact elements are made by:

applying at least one layer of masking material on the surface of the semiconductor wafer;

pattering the masking layer to have openings extending from bond pads on the semiconductor devices resident on the semiconductor wafer to positions which are above the surface of the semiconductor wafer and which also are laterally and/or transversely offset from the bond pads;

depositing at least one layer of a conductive metallic material into the openings; and

removing the masking material so that the remaining conductive metallic material forms free-standing spring contact elements.